UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

31 JUL 1989

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: REGISTRATION OF PERMETHRIN FOR MILITARY USES
(HED PROJECT #9-1356)

TO: G. LaRocca, PM 15
Insecticide and Rodenticide Branch
Registration Division (H7505C)

FROM: Curt Lunchick
Environmental Chemistry Review Section
Non-Dietary Exposure Branch
Health Effects Division (H7509C)

THRU: Michael Firestone, Ph.D., Section Head
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THRU: Charles L. Trichilo, Ph.D., Chief
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Please find below the NDEB review of ....

HED Project #: 9-1356

RD or SRRD Record #: 50404L

Caswell #: 652BB

Date Received: 04/26/89 Review Time: 2 days

Date Returned: 07/31/89

Deferral to: ____ Biological Analysis Branch/BEAD

____ Science Analysis & Coordination Branch

__X__ TP - Insecticide/Rodenticide Support Section

____ TP - Herbicide Fungicide Antimicrobial Support Section

1.0 INTRODUCTION

Coulston International Corporation has submitted on behalf of the U.S. Army Research Development and Engineering Center, additional information in support of the registration of permethrin for use on Battle Dress Uniforms (BDUs). The additional information is in response to the September 23, 1988 review of the registration request by L. Kutney (HED Project No. 8-1077A).

The product in question contains 0.5% permethrin as the active ingredient. It is packaged in a 6 oz aerosol and is intended to repel or kill ticks, mosquitos, and chiggers. According to RD, the material is already registered for civilian use as the product Permanone. The military is seeking a separate registration for use in the field by uniformed members of the Armed Services.

Fairfield America has submitted on behalf on the Department of Defense (DOD) a request to register Perigen Industrial Mothproofer. Perigen contains 12% permethrin as the active ingredient and is currently registered for civilian use according to RD. The DOD would like to use Perigen to impregnate military wool and wool-blend fabrics.

2.0 CONCLUSION

The Nondietary Exposure Branch (NDEB) estimates that the dermal exposure from wearing permethrin treated BDUs will average 0.0056 mg/kg/day and total 2.0 mg/kg/year for a 70 kg individual. The estimates are not adjusted for the dermal absorption of permethrin (assumes 100% absorption) and are based on the unlikely scenario of an individual wearing the BDU for 24 hours/day and for 365 days/year. These estimates assume that only 4 percent of the permethrin in BDUs will migrate to the skin; however, NDEB defers to TB-IPS review and evaluation of this assumption derived from a rabbit study (MRID No. 407668-13).

Exposure to Perigen-treated cots and other nonclothing fabrics is assumed to be even less than to that received wearing permethrin-treated clothing.

3.0 DISCUSSION

The proposed permethrin aerosol contains (0.5% x 6 oz x 28,000 mg/oz) 840 mg permethrin. Based on proposed label directions, 75 percent of the contents are to be applied to BDUs and the remaining 25 percent to mosquito netting. Therefore, 630 mg permethrin are applied to BDUs. Coulston has determined

that the surface area of a BDU is 57,200 cm^2. When one assumes that approximately half (the inner surface) is in contact with the skin, the total surface area of a BDU contacting the skin is 28,600 cm^2. If the entire 630 mg permethrin were to adhere to the BDU, the concentration of permethrin on the BDU available for skin contact would be 0.022 mg/cm^2.

The Army field tested the aerosol can applications in the Everglades between April 28 and May 8, 1988 (Attachment C of Coulston February 23, 1989 submission). The BDUs averaged 0.027 mg permethrin/cm^2 as measured by gas chromatography. NDFB will utilize the field measurement in its calculations. Attachment C also provides permethrin concentrations on BDUs after laundering. The concentrations were as follows:

Launderings	Permethrin (mg/cm^2)
0	0.027
2	0.015
5	0.009
10	0.007

Based on the proposed label, the BDUs are retreated every sixth week after six launderings. Coulston states the average field lifespan of a BDU is 120 days.

The surface area of a 70 kg adult male is 17,420 cm^2 for the arms, legs, and torso (Subdivision U, Pesticide Assessment Guidelines). Based on the laundering data, a maximum total of 0.020 mg/cm^2 would be available after 10 launderings (0.027 mg/cm^2 at application minus 0.007 mg/cm^2 after 10 launderings equals 0.020 mg/cm^2 available). The permethrin available would actually be less after six launderings. Based on the 0.020 mg/cm^2 permethrin not retained in the BDU and a skin contact area of 17,420 cm^2, a total of 348 mg permethrin can potentially be available for dermal absorption over the 6-week period prior to reapplication. For a 70 kg individual, the average daily potential exposure would be (348 mg/42 days x 1/70 kg) 0.12 mg/kg/day over the first 6-week period.

After 6 weeks, the BDU would be retreated at 0.027 mg/cm^2 which added to the prior treatment residues of approximately 0.008 mg/cm^2 after six launderings would yield an initial second treatment residue level of 0.035 mg/cm^2. The laundering data indicated that 74 percent of the 0.027 mg/cm^2 was removed after 10 launderings. If one assumes that 74 percent of the 0.035 mg/cm^2 residue level is removed and all is available for dermal absorption, then 0.026 mg/cm^2 is available. Based on 0.026 mg/cm^2 not retained in the BDU during the second 6-week period and a skin contact area of 17,420 cm^2, a total of 453 mg

permethrin can potentially be available for dermal absorption. For the 70 kg individual, the average daily exposure over the second 6-week period would be (453 mg/42 days x 1/70 kg) 0.15 mg/kg/day.

At the end of the second 6-week period, the BDU would have retained 0.009 mg/cm^2 permethrin residues. The third and final spray application of 0.027 mg/cm^2 added to the 0.009 mg/cm^2 would yield an initial third 6-week period residue level of 0.036 mg/cm^2. Again assuming 74 percent of the residues are removed, a total of 0.027 mg/cm^2 would be available for potential exposure. The average daily exposure over this third 6-week treatment period would be 0.16 mg/kg/day. The overall potential daily amount of permethrin available for exposure over the three-treatment, 120-day life of the BDU would average 0.14 mg/kg/day. This three-spray cycle for a BDU could be repeated twice more during one year. An individual wearing three BDUs over a 1-year period would have a potential dermal exposure of 51 mg/kg/year assuming all permethrin not retained after laundering is available for dermal exposure.

The average daily amount of permethrin available for dermal exposure of 0.14 mg/kg/day is probably an overestimate of the actual amount leaching from the BDU onto the skin. The vast majority of the permethrin removed from BDUs may be removed during laundering. A study submitted by the registrant (Snodgrass, H.L., U.S. Army Environmental Hygiene Agency, 1988, Mitigation of Permethrin From Impregnated Military Fabrics as Measured in Rabbits, MRID No. 407668-13) concluded that 4 percent of the permethrin in treated military dress fabric migrated to rabbit skin. NDEB defers review of this rabbit study by Toxicology Branch I-IRS. If it is assumed that 4 percent of the permethrin not retained by the fabric migrates to the skin of the wearer (conversely, 96 percent of the nonretained permethrin is either removed during laundering or lost through other processes), the total dermal exposure to permethrin in BDUs would be (0.14 mg/kg/day x 0.04) 0.0056 mg/kg/day or 2.0 mg/kg/year for 365 days.

cc: Circulation
SACB (Linda Kutney)
Permethrin File
Correspondence File